CONTENTS

ef

1 INTRODUCTION

of Testing

Testing

Of of Testing

Scope and Contents of

Key

Reference

2 CONVENTIONAL TEST METHODS

Environment for Testing

Test Environment

Conventional Test Methods 46

Characteristics Conventional Methods

of Test Points

References

3 PROBLEM INTERPRETING

Testing

Example of the

CONTENTS

Conventional Test Methods

nfo ity

imitations Tester Tech ologies and Test Methods

erta ing Synchronization terface

Value

ey

Re 68

4 D GN O T TAB L T V

Testability

low Sys Te

4.3 low nos bility

ppa Design

Evalu wo d Tes io

ey 96

Reference

5 LATCH SCANN NG ARRAN M NT

for tch nd

igt of Latch- anning Arrangeme

Publi

Opera f

Modif of Se

Tin in Operation

eigenvalues between Scan Pat nd LS

Impe a d of

Key Po

afer

SWITCHING OF INPUT/OUTPUT PORTS

6.1 *Second Main Step Toward In-System At-Speed Testability* . . 136

6.2 *Partitioning* 137

6.3 *Switching of Output Ports* 141

6.4 *Multiplexing and Demultiplexing of Input and Output Ports* 149

Summary of Key Points 165

References 166

INTERNAL PATTERN GENERATION AND RESPONSE COMPACTION

7.1 *Introduction* 169

7.2 *Generation of Pseudorandom Patterns* 172

7.3 *Compaction of Test-Response Patterns* . 175

7.4 *Superposition and Compensation* 180

7.5 *Implementation of Pseudorandom-Pattern Tests* 182

Summary of Key Points . 203

References 205

8 ISOLATION AND SELF-SUFFICIENCY

8.1 *Introduction* 213

8.2 *Leading Cases in Point* 215

8.3 *Incorporation of Isolation and Self-Sufficiency* 221

8.4 *Chip-Level Isolation and Self-Sufficiency* 224

8.5 *ISAST Design by Using On-Chip Feedback* 228

8.6 *Extension of ISAST to Higher Package-Levels* 235

Summary of Key Points 248

References 251

SOFTWARE AND EQUIPMENT SUPPORTS

9.1 *Introduction* . . . 260

9.2 *Main Types of Test-Software Supports* 265

9.3 Recent Developments 280
Summary of Key Points 284
References 288

TAKING STOCK AND LOOKING AHEAD

10.1 Evaluation 313
10.2 Taking Stock 320
10.3 Analysis 334
10.4 Possibilities for Optimization 363
10.5 Looking Ahead 376
Summary of Key Points 388
References 392

A PENNY FOR MY THOUGHTS?

11.1 A Bunch of Questions 394
11.2 Two Frontiers for Progress 417
11.3 A Bouquet of Hopes 426
Summary of Key Points 443
References 444

FUTURE OF TEST-ENGINEERING

12.1 Future Role of Test-Engineer 447
12.2 Future of ATE 451
12.3 Viva Design for Testability! 456
Summary of Key Points 469
References 471

Appendixes

A LATCHES, MULTIPLEXERS AND DEMULTIPLEXERS

A.1 Functions of Latches, Multiplexers and Demultiplexers . . 473
A.2 Basic Structure of Flipflop 475
A.3 Basic Structures of Latch Circuits 484

A.4 Polarity-Hold Latch Based on Using AND-OR Flipflops 486
A.5 Polarity-Hold Latch Based on Using NOR/NAND Flipflops 495
A.6 Multiplexers and Demultiplexers for Path Switching 497
Summary of Key Points 508
References 509

B TIMING CONSIDERATIONS FOR LATCH AND LSA OPERATION

B.1 Timing Considerations for Latch Operation 511
B.2 Analysis of Scan-Path LSA Circuit 521
B.3 Analysis of LSSD-SRL Circuit 525
B.4 Differences between Scan-Path and LSSD-SRL 525
B.5 Aspects of Comparison 527
B.6 Single- vs. Double-Clock Control: Reliability of Operation 536
B.7 Single- vs. Double-Clock: Design Flexibility and Cycle-Speed . . . 541
B.8 Single- vs. Double-Clock Control: Costs 554
Summary of Key Points
References 558

C OPERATION OF PATTERN GENERATORS AND COMPRESSORS

C.1 Introduction . . . . . .
C.2 Pseudorandom-Pattern Generation . . . 559
C.3 Pattern Compression 563
C.4 Superposition and Compensation . 568
Summary of Key Points 583
References 584

Bibliography: Explanations of Abbreviations Used 585
Bibliography: Papers . . . 591
Books . . . 681
Subject Index